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IS 5425-2 (1984): Methods of chemical analysis of misch metal, Part 2: Determination of total rare earths [MTD 7: Light Metals and their Alloys]

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IS : 5425 ( Part 2 ) - 1984

*Indian Standard*

METHOD OF  
CHEMICAL ANALYSIS OF MISCH METAL

**PART 2 DETERMINATION OF TOTAL RARE EARTHS**

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INDIAN STANDARDS INSTITUTION  
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NEW DELHI 110002

*Indian Standard*METHOD OF  
CHEMICAL ANALYSIS OF MISCH METAL

## PART 2 DETERMINATION OF TOTAL RARE EARTHS

Methods of Chemical Analysis of Non-Ferrous Metals  
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*Indian Standard*METHOD OF  
CHEMICAL ANALYSIS OF MISCH METAL

## PART 2 DETERMINATION OF TOTAL RARE EARTHS

## 0. FOREWORD

**0.1** This Indian Standard ( Part 2 ) was adopted by the Indian Standards Institution on 27 September 1984 after the draft finalized by the Methods of Chemical Analysis of Non-Ferrous Metals Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** Misch metal is an alloy of rare earth metals and is used for improving strength, fluidity and other properties of cast iron, steel, aluminium, magnesium, and nickel alloys to which it is added. The committee decided to cover the chemical analysis of misch metal in parts. In Part 1 determination of cerium has been covered. This part covers method for the determination of total rare earths in misch metal. Determination of iron, aluminium, calcium, magnesium and carbon will be covered in subsequent parts.

**0.3** The method prescribed in this standard is an indirect method for determination of lanthanum. The average atomic weight of rare earths ( 141.6 ) has been calculated by taking an average atomic weight of elements present in rare earth prepared from Indian monazite.

**0.4** In reporting the result of a test or analysis made in accordance with this standard; if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960\*.

## 1. SCOPE

**1.1** This standard ( Part 2 ) covers the method for determination of total rare earths in various grades of misch metal as given in IS : 4182-1967†.

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\*Rules for rounding off numerical values ( *revised* ).

†Specification for misch metal.

### 3. GENERAL

**3.1 Use of Filter Paper** — In the method prescribed in this standard, relative number of Whatman filter paper only have been given, since these are commonly used. However, filter papers of any other suitable brand with equivalent porosity may be used.

### 3. QUALITY OF REAGENTS

**3.1** Unless otherwise specified, pure chemicals and distilled water ( see IS : 1070-1977\* ) shall be employed in the tests.

NOTE — ' Pure Chemicals ' shall mean chemicals that do not contain impurities which affect the results of analysis.

### 4. DETERMINATION OF TOTAL RARE EARTHS

**4.1 Outline of the Method** — The sample is dissolved in dilute hydrochloric acid. The rare earths are precipitated as oxalates, ignited and weighed as their oxides. The rare earth metal content is then calculated correcting for cerium oxide ( $\text{CeO}_2$ ) and assuming an average atomic weight of 141.6 for the other rare earths.

NOTE — The average atomic weight changes slightly depending on the composition of rare earths in the source material. 141.6 is the average atomic weight for rare earth from Indian monazite.

#### 4.2 Reagents

**4.2.1 Dilute Hydrochloric Acid ( 2.5 N )**

**4.2.2 Oxalic Acid Solution** — Prepare a saturated solution at room temperature.

**4.2.3 Wash Solution** — Dissolve 2.0 g of oxalic acid in 100 ml of water containing 1 ml of concentrated hydrochloric acid ( rd = 1.16, conforming to IS : 265-1976† ).

#### 4.3 Procedure

**4.3.1** Weigh 2.000 g of the sample into a beaker. Add 50 ml of dilute hydrochloric acid to dissolve the sample. Make up the volume of the solution to 200 ml in a volumetric flask.

**4.3.2** Take 25.0 ml aliquote ( see 4.3.1 ) into a 400 ml beaker, dilute to 200 ml and adjust the pH to 1.0 by adding dilute hydrochloric acid. Heat the solution to boiling and add gradually 60 ml of oxalic acid solution with constant stirring. Allow the precipitate to stand overnight. Filter through Whatman No. 40 filter paper and wash three or four times with about 10 ml of wash solution each time.

\*Specification for water, for general laboratory use ( second revision ).

†Specification for hydrochloric acid ( second revision ).

**4.3.3** Transfer the filter paper containing the oxalate precipitate to a platinum crucible, previously weighed with lid, heat slowly to charring and then at 600°C to constant mass.

**4.3.4** Place the lid on the crucible, cool it in a desiccator and weigh quickly (*A*).

#### 4.4 Calculation

Mass of oxides of rare earths = (*A* - *B*)  
other than CeO<sub>2</sub> in g

$$\text{Mass in g of rare earths} = \frac{(\text{A} - \text{B}) \times 141.6}{165.6}$$

$$\text{Mass in g of cerium (Ce)} = \frac{\text{B} \times 140.1}{172.1}$$

$$\text{Total rare earths, percent} = \left[ (\text{A} - \text{B}) \frac{141.6}{165.6} + \frac{\text{B} \times 140.1}{172.1} \right] \times 400$$

where

*A* = mass in g of rare earth oxides as obtained in **4.3.4**, and

*B* = mass in g of cerium oxide (CeO<sub>2</sub>) in 25 ml aliquote  
[determined in accordance with IS : 5425 (Part 1)-1969\*].

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\*Method of chemical analysis of misch metal : Part 1 Determination of cerium.

# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>